DOCUMENT RESUME

ED 110 504 TM 004 777

AUTHOR Anderson, Lorin W.
TITLE A Measure of Student Involvement in Learning: Time-on-Task.
NOTE 24p.

EDRS PRICE MF-$0.76 HC-$1.58 PLUS POSTAGE
DESCRIPTORS *Academic Achievement; Attention Control; *Classroom Observation Techniques; Classroom Research; Elementary Secondary Education; *Learning; Learning Processes; Recall (Psychological); Statistical Analysis; *Student Behavior; Task Analysis; *Task Performance; Time Factors (Learning)

ABSTRACT

The importance of appropriate task relevant behaviors as a necessary condition for school learning has long been noted. This paper suggests a multiple measure of one set of student classroom behaviors, presents a brief theoretical basis for the measure, provides some empirical support for the use of the measure, and indicates some educational research problems for which the measure is applicable. The empirical evidence (based on three samples of junior high mathematics students (N=137) supports the necessity of using a multiple measure in various learning situations. Suggestions of research problems include an investigation of variables which might be related to and affect task relevant behaviors, and an exploration of the differences between "fast" and "slow" learners. (Author)

ED110504

A Measure of Student Involvement in Learning: Time-on-Task

Lorin W. Anderson

University of South Carolina

TM 004 778

Abstract

The importance of appropriate task relevant behaviors as a necessary condition for school learning has long been noted. This paper suggests a multiple measure of one set of student classroom behaviors, presents a brief theoretical basis for the measure, provides some empirical support for the use of the measure, and indicates some educational research problems for which the measure is applicable.

The empirical evidence (based on three samples of junior high mathematics students (N = 137)) supports the necessity of using a multiple measure in various learning situations.

Suggestions of research problems include an investigation of variables which might be related to and affect task relevant behaviors, and an exploration of the differences between "fast" and "slow" learners.

A MEASURE OF STUDENT INVOLVEMENT IN LEARNING: TIME-ON-TASK

Student behavior in the classroom, its control, and its relationship to student learning have long been of importance in educational literature. The purpose of this paper is to suggest a measure of one set of student behaviors in the classroom, to give a theoretical basis for the development of the measure, to present some empirical evidence to support the use of the measure, and to indicate some important educational research problems for which the procedures are applicable.

If one were to walk into a classroom and simply watch the students for the entire class period, one would be able to see that while some students appear to be constantly involved in class work and classroom processes, others are constantly involved in activities which are not related directly to the classroom activities. Examples of these activities include looking off into space, sharpening pencils several times in one class period, passing notes to other students, and wandering around the classroom. One can easily imagine that these students will learn varying amounts in that particular class period.

The students who consistently display disruptive or deviant classroom behaviors have received a great deal of concern by educators. Patterson, Cobb and Ray (1971) summarize various research studies which have been conducted to find the differences in the behaviors exhibited by the disruptive and "normal" child. These studies suggest that deviant students are out of their seats approximately twice as often as "normal" students, they were noise producers 25 times as often, and they attended to the task between 39 and 54 percent of the time in contrast to the normal students' range of 75 to 82 percent of the time.

Thus, the observation of our naive observer has a certain amount of support in the research literature. However, the research support found in the literature cited may only hold when students are dichotomized into the "very deviant" and the "academically skilled."[1]

There have been several educators[2] over the past fifty years who have speculated about the relationship between student behaviors and learning over the entire range of students in the classroom. These beliefs can be summarized by a single statement of Ralph Tyler (1950): "Learning takes place through the active behavior of the student; it is what <u>he</u> does that he learns." (p. 41)

Much of the early work on student behaviors have used the concept of attention that was borrowed from early psychological learning theorists.[3] This concept focused on "attentive behaviors"[4] that has recently led to the concept of "mathemagenic behaviors."

Mathemagenic behaviors, according to Rothkopf (1970), are behaviors which give birth to learning. He posits three forms of mathemagenic behaviors: orientation, object acquisition, and translation and processing.

Rothkopf states that while the first two sets of behaviors are generally observable, the third set of behaviors is not. More recently, Tyler (1973) refers to two distinct types of student behaviors: those that are observable (e.g., writing) and those that are not observable (e.g., thinking). It seems necessary to conceive of student behaviors in the classroom as consisting of both observable (overt) and non-observable (covert) behaviors.

Researchers who have been interested in investigating the relationship of student behaviors and achievement more directly have concerned themselves with student behaviors in the narrow sense of observable behaviors. Their attempts to investigate the relationship of student task-relevant behaviors and achievement have involved the use of classroom observation schedules. Correlations between task-relevant behaviors and achievement produced by these studies have a median of approximately .45 with a range of correlations from .30 to .55.[5] While the classroom observation schedule is effective at differentiating students' overt behaviors, it lacks the ability to examine the covert behaviors of the students.

There have been, however, researchers who have been interested in investigating the covert behaviors of the student and their relationship to learning. These researchers have attempted to infer the non-observable behaviors by using "stimulated recall technique" developed by Bloom (1953). Correlations between task-relevant behaviors and achievement produced by these studies have a median of approximately .50 and range from .45 to .60.[6]

Since according to both Rothkopf and Tyler both overt and covert behaviors of the students are relevant to learning it would seem necessary for an instrument which professes to measure student behaviors to consist of both an indicator of overt and covert behaviors. This is the rationale underlying the development of the instrument presented in this paper.

The Instrument: Overt Measure

The overt measure of student behavior is a classroom observation instrument. The instrument used for this purpose is a modification of one used by Cobb and Hops (1972). The classroom coding sheet is divided into four categories: attention (A), work (W), other (OTH), and not relevant to the task (N).

Attention (A) is used to code behaviors of the student which indicate to the observer that the student is physically attending to the task. For example, in a lecture situation, the behavior is coded A if the student is looking at the teacher or at the blackboard on which the teacher is writing. In a seatwork situation, the behavior is coded A if the student is looking at the book, worksheet, or paper on which he has been working.

Work (W) is used to code behaviors which produce evidence that the student is, or has been, working on the task. For example, in a lecture situation, the behavior is coded W if the student is taking notes or copying a problem or example off the blackboard. In a seatwork situation the behavior is coded W if he is working on a written assignment. The behavior is also coded W if the student is moving his lips as he reads, is taking notes as he reads, or is underlining passages as he reads.

The Other (OTH) category is used to code any of five on-task behaviors that are not contained in the first two categories. These behaviors are: talking to the teacher about academic material, talking to a peer about academic material, volunteering in class, asking the teacher a question or asking him for help, and complying to the requests and/or demands of the teacher.

If none of the above behaviors are observed the student's behavior is coded as being not relevant to the task (N).

The following procedure is used with the observation schedule. The observer sits at one side of the classroom near the front. The position of the observer is chosen in such a way as to be able to see the faces of all of the students in the class. At the beginning of the class period the observer watches a randomly selected student for a period of five seconds, codes the behavior in one of the categories, and looks to the next student in the row. He observes the second student for a five-second interval, codes the behavior in the appropriate category, and looks to the third. The same procedure is followed until the entire class is appropriately coded. Theobserver then takes a second coding sheet, begins with a second randomly pre-selected student, and repeats the above procedure. This procedure is continued until the end of theclass period.

Several points concerning the overt measure of classroom behavior should be made at this time.

First, there is a possibility of a student exhibiting multiple behaviors within any five-second interval. For example, a student may be looking at the clock for two seconds, looking at his book for two seconds and writing on his paper for one second. When this occurs, the student is coded in the behavior category of longest duration. In the case of situations such as the one given in the above example, the following procedure is used. The student is engaged in non-task relevant behaviors for two seconds and task relevant behaviors for three seconds. Therefore, the interval is a task-relevant interval. Further, within the task relevant categories the student is exhibiting behaviors of category A for two seconds and behaviors of category B for one second. The behavior category for the entire interval is coded B for one second. The behavior category for the entire interval is coded A.

A second point of importance concerns the need for obtaining a measure of objectivity when using an observation schedule. This need has been pointed out in most articles which have been concerned with systematic observation procedures. Perhaps the most effective way of dealing with the problem is to have a pair of observers in each classroom. Objectivity can be estimated by using a measure of the per cent of observer agreement, i.e., the number of agreements divided by the number of agreements plus disagreements. It may not be possible for two observers to be in the same classroom during the entire classroom period. As an alternate procedure a second observer could enter the classroom at certain time periods and code several sheets in conjunction with theoriginal observer. However, this procedure is less preferred than theooriginal suggestion for at least two reasons. First, the movement of the second observer in and out of the classroom may cause larger "observer effects" on the students. With observers consistently in the classroom, studies have demonstrated the apparent non-effect of observers. (See, for example, Heyn and Lippitt, 1954) Second, theoriginal observer may differ in his "carefulness" of observation depending on whether or not his observations are being "checked" by a second observer. (See, for example, Reid, 1970) With two observers constantly serving as a system of checks and balances, this problem may be at least partly eliminated. The per cent of observer agreement in the study reported in this paper ranged from 70% to 90% for the individual categories.

The third and final point of importance concerning the overt measure has to do with the method of scoring the observations. In the study in which this instrument was initially used the following procedure was followed. The observational technique yielded a set of data points for each student. The student's per cent of time engaged in task relevant behaviors over the entire class period was estimated from the set of data points by dividing the total number of data points that were coded as one of the task-relevant behaviors (A,W,OTH) by the total number of data points.

Despite the decision in the initial study to collapse the three task relevant categories into one, it must be emphasized that this does not imply that only two categories (task relevant versus task irrelevant) are needed. There may be certain situations (because of subject matter, age level, instructional strategy) in which one of the categories does not appear to function as predicted. It may be the case that one of the categories is negatively related to achievement. If three categories of on-task behaviors are used, this negative relationship (for whatever reason) can be eliminated temporarily while the relationship between the other two task relevant behavior categories and achievement is examined. By using an instrument which has multiple categories of on-task behavior the categories can be collapsed if the situation warrants it. Unfortunately, the reverse is not true. We cannot produce three categories out of one <u>ex post facto</u>. Further, if the purpose of using the instrument is to assess individual students the multiple category system may be extremely useful.

The Instrument: Covert Measure

The second measure of student behaviors consists of a stimulated recall technique (adapted from Bloom, 1953). This technique involves having the student recall what he was thinking about during the class period. This technique is a useful one for two reasons. First, it provides a minimum of interference with the original learning situation. Second, there is relatively good recall shortly after the class period.

In a lecture or discussion class period, the presentation is recorded on tape. Immediately after the class, the tape recording is replayed to the class. Three or four minutes of the tape are played initially in an attempt to help the students better remember the class period. After this initial time period, the tape is stopped and the students are asked to write (or tell) in a few sentences the thoughts they were having at this point in the original classroom proceedings.[7] The tape is then moved forward to another part of the presentation and a second one-to-two minute segment is played. Once again the students are asked to write down the thoughts they were having in class. This procedure is continued until the classroom presentation is completed or until a sufficient number of data points have been collected.

During a seatwork situation the covert procedure must be modified since no collective stimulus is present in the classroom. After two observer "scans" of the classroom have been completed, the observer signals to the teacher who instructs the students to stop and write in a few sentences what they were thinking just prior to the teacher's voice.[8] The students are further instructed to resume work as soon as they have finished writing their thoughts.

The student self-reports are given to two individuals who code the thoughts as being relevant to the task or irrelevant to thetask. Two coders are used for the purposes of objectivity. In a lecture or discussion situation, task relevant thoughts are those relevant to the material being discussed in class at the time the tape was stopped. In a seatwork situation, task-relevant thoughts are those relevant to the assignment. The student's reported thought is classified as task relevant if he reports attempts to remember or comprehend (translate or illustrate) ideas under consideration in class or ideas related to the class or the subject independent of those under consideration. Also, if he reports applying, generalizing, synthesizing, or evaluating the ideas under consideration or ideas related to the class or the subject, his thought is classified as task relevant.

The student's reported thought is classified as task irrelevant if he reports no recall of thoughts, emotional reactions to what was going on in class, thought(s) related to persons or objects within sight or hearing, or thought(s) related to persons or objects not in sight. In the study which will be reported later in this paper, the intercoder agreement was approximately 89 per cent.

This method also produces a set of data points for each student. Once again the students' per cent of time engaged in task relevant behavior over the entire class period is estimated by dividing the number of data points coded as task relevant by the total number of data points.

Time-on-Task

It is necessary with the two measures of task relevant behaviors to arrive at an overall estimate of time-on-task (i.e., the per cent of time that the student was engaged in task relevant behaviors). It was found in the initial study that the correlation of the simple arithmetic average of the per cent of overt and covert task relevant behaviors with achievement did not differ significantly from the multiple correlation of the per cent of overt and covert task relevant behaviors with achievement. Because a single indicator or measure of time-on-task is more easily understood and interpreted in an experimental study, it was decided to operationally define per cent of time-on-task as the arithmetic average of the per cent of overt task relevant behaviors and the per cent of overt task relevant behaviors. It should be pointed out, however, that in descriptive studies which are wholly predictive in nature it may be that the multiple correlation of the per cent of overt and covert task relevant behaviors may yield substantially higher correlations with achievement. An alternate method which was also investigated in the initial study with this composite instrument involved the use of factor analysis and factor scores of the per cent of task relevant behavior. When this was done the correlation of the per cent of task relevant behavior with achievement was not significantly different from those obtained by either of the other two methods.

Despite the decision to combine the two measures of task relevant behaviors into a single score, it is important to cite the empirical evidence which supports the necessity of using both overt and covert measures. We turn to this empirical justification in the next section.

The Importance of a Multiple Observation of Time-on-Task: Some Empirical Evidence

The associational relationship between time-on-task and achievement was tested in three samples: a seventh grade arithmetic class, an eighth grade matrix arithmetic class, and a ninth grade algebra class. In the arithmetic and algebra classes the class procedure consisted of approximately twenty minutes of teacher presentation followed by approximately thirty minutes of assigned seatwork. In the matrix arithmetic class, the entire class period was spent by the students working in their seats on programmed material. The criterion measure for each of the samples was an achievement test based on the content and objectives of the unit. It was constructed based on the principles of formative evaluation instruments. (Bloom, Hastings, and Madaus, 1971) The duration of each unit was one school week.

We first turn to an examination of the means, standard deviations, and correlations of each of the two measures of task relevant behaviors in the three samples in the two learning situations (lecture, seatwork).

There is a general trend over the three samples (arithmetic, matrix arithmetic, and algebra) for the overt measure to yield higher mean per cents of task relevant behavior than does the covert measure. In other words, there is a tendency for the observer to report that the student is engaged in task relevant behavior more often than the student's covert behavior indicates that he is engaged in task relevant behavior. In addition, there is a tendency over all three samples for the overt measure to have a smaller standard deviation than does the covert measure. One possible reason for these findings is that students learn to simulate the overt classroom behaviors desired or expected by the teacher. Covert behavior, on the other hand, may be reported more accurately if the student does not feel he will be penalized by the teacher. These trends can be seen quite clearly by examining Table 1.

It is of further interest to point out that the standard deviation of the overt measure in the matrix arithmetic sample is approximately two-thirds of the standard deviation of the overt measure in the other two samples. A possible reason for this is that programmed learning narrows the perceptual field of the student to such an extent that more students appear to be on-task more often since they are all looking down at the programmed text.

When we turn to an examination of the differences in the relationships between the overt and covert measures of task relevant behaviors and achievement, we see some of the effects of the above variability in standard deviations. The correlations between the covert measure and achievement in the three samples fall within a fairly narrow range from .47 and .55. The range of the correlations between the overt measure and achievement is much greater, from .39 and .68 in the three samples.

Table 2 shows the correlations of the components of the time-on-task measure and achievement as well as the intercorrelations between the two components of time-on-task in the three samples.

All of the correlations in Table 2 are significant ($p < .05$), including the intercorrelations between the two time-on-task components.

A somewhat more interesting and informative way of examining both the standard deviation and correlations is to divide the class period into lecture and seatwork components and to look at the standard deviations of the time-on-task measures and correlations between the overt and covert measures and achievements in the three samples. The class work in the matrix arithmetic consisted entirely of seatwork using programmed materials while the class work in the two other samples consisted of a combination of lecture and seatwork.

We turn first to a comparison of the standard deviations of the overt measure in the lecture and seatwork components of the classes. (See Table 3.) When this is done we find that the standard deviation of the overt measure taken during the seatwork component of the arithmetic and algebra classes is approximately the same as it is in the matrix arithmetic class. The standard deviation for the arithmetic sample is 9.45, for the algebra sample it is 10.34, and for the matrix arithmetic sample it is 8.34. It appears that it is quite difficult for the overt measure to differentiate among students in a seatwork situation.

In contrast we find that the standard deviations of the overt measure in the lecture situation are 16.92 and 14.68 for the arithmetic and algebra classes, respectively. These larger standard deviations suggest that differentiations among students in the lecture situation are more easily picked up by the overt measure.

The covert measure, on the other hand, is more stable in terms of standard deviations over the three samples and in both the lecture and seatwork situations. The range of standard deviations over all the samples and learning situations is from 15.67 to 19.18.

When we turn to an examination of the correlations in Table 3[10] we see that the correlations between the covert measure and achievement are very stable across all samples and in both learning situations. The correlation between the overt measure and achievement is stronger in thelecture situation than in the seatwork situation in both samples. In fact, there is virtually no correlation between the overt measure and achievement in the seatwork situation in the arithmetic sample.

In general, when we examine the standard deviations and correlations we see that the two components of the time-on-task measure function quite differently in different situations. The overt measure tends to discriminate among students lessd well in a seatwork situation. Both measures tend to discriminate equally well in lecture situations. The covert measure appears to be quite stable in its ability to discriminate among students in both the lecture and seatwork situations. Finally, the correlation between the overt measure and achievement varies from the lecture situation (where it relates quite highly) to the seatwork situation (where its relationship with achievement is not at all clear). The correlation between the covert measure and achievement appears to be quite stable over both learning situations. It is important to point out at this time that with but one exception, the relationship between time-on-task (the composite measure) and achievement is higher than the relationship between achievement and either the overt or the covert measure by itself. The correlations between composite time-on-task and achievement in the arithmetic, matrix arithmetic, and algebra classes were .59, .58, and .62, respectively. (See Table 2.)

The above discussion provides some empirical support for the necessity of a multiple measure of student task relevant behavior or time-on-task.

Qualitative Differences in Student Task Relevant Behaviors

The instrument proposed in this paper is concerned with the quantitative differences in student task relevant behaviors. A student's behavior is either task relevant or not task relevant at a given point in time. This conception of student behaviors totally omits the qualitative differences which exist between students. In other words, this instrument does not distinguish between two students who are involved in learning for two minutes. What can be said about these two students in regard to this instrument is that they are involved in task relevant behaviors for the same amount of time. We cannot say that the behaviors really indicate the same degree of involvement in learning. There has been at least one study which attempted to examine qualitative differences in task relevant behaviors. (See Oczelik, 1973.) However, the relationship between task relevant behaviors and student achievement was similar to that found in the study which used the instrument presented in this paper.

Possible Uses of the Time-onTask Measure

Anyone proposing a new measure must take the responsibility of demonstrating or speculating about possible uses for the new measure. It is the purpose of this section to suggest possible uses of the time-on-task measure.

One use of the instrument has already been mentioned. The instrument can be used to investigate the relationship between student behaviors and achievement. However, a second use of the instrument which is closely related to the above one concerns the investigation of variables (including characteristics of the learning environment, teacher, and student) which might be related to and affect the students' task relevant behaviors.

The measure might also be used to compare various learning materials and learning programs. If further research supports the high relationship between student behaviors and achievement, the measure can be used as a means of evaluating instructional programs while they are in the process of being tested or used. If this is the main purpose for using the instrument, one suggestion can be given. If the experiment involves two or more classes, each using a different program, it is possible to randomly select a small sample (say, 10 students) in each class instead of using the entire class. By doing this, the researcher or evaluator is provided with more data points per student, thus increasing the reliability of the instrument. In conncection with this use of the instrument, one specific example for which it might be used is in the comparison of individually paced instruction with group paced instruction, or a comparison of "open" classrooms with more traditional classrooms.

The instrument can also be used to try to explain wide differences in achievement of selected groups of students. Wiley (1973) was able to re-examine the Coleman data for one large urban school system on the basis of quantitative differences in schooling. He found that by using average daily attendance, hours of schooling per day, and days of schooling per year as his measure of time-in-school that schools differed by as much as 50 per cent in terms of the average time in which students were in school. These quantitative differences were highly related to the qualitative differences (achievement) in schools. The present instrument would allow a more precise look into the classroom at the ways in which students spend their time. Perhaps this will shed some light on the manner in which quantitative differences in schooling relate to and affect achievement differences. One logical extension of this particular use of the instrument would be the investigation of cultural and national differences in achievement which have consistently been found.

One final use of the instrument may be to explore the age-old problem concerning the differences between so-called "slow" learners and "fast" learners. While most educators attest to the fact that there is a difference, we have very little information on the nature of that difference. Specifically, is it that "fast" learners really work at a faster rate, or that "fast" learners spend more of their time engaged in task relevant behaviors? In a small scale study in which only a classroom observation schedule was used, researchers at the University of Pittsburgh Learning Research and Development Center (Shimron, 1973) obtained results which tend to support the second answer to the above question.

Conclusion

The importance of student behaviors as a key to student learning has long been hypothesized in educational writing. Unfortunately, there has been a paucity of research conducted which addresses this hypothesis. It has been suggested that one of the reasons for such a lack of research might lie in the difficulty of measuring or assessing student task relevant behaviors. This paper has suggested a multiple observation method of measuring the per cent of student task relevant behaviors in a particular class period. The necessity of using a multiple observational method has been examined from a theoretical framework as well as by examining some empirical evidence. It is hoped that this instrument will be used in the investigation of educational problems, specifically those mentioned above.

Table 1

MEANS AND STANDARD DEVIATIONS OF THE OVERT, COVERT, AND TOTAL ((OVERT + COVERT)/2) PER CENT OF TIME-ON-TASK

Sample/Measure	N	Mean	Standard Deviation
Arithmetic	27		
Overt		73.78	12.76
Covert		56.36	17.43
Total		65.07	12.98
Algebra	28		
Overt		76.01	12.32
Covert		71.71	16.76
Total		73.86	13.20
Matrix Arithmetic	82		
Overt		86.27	8.34
Covert		60.32	18.13
Total		73.68	11.23

Table 2

CORRELATIONS BETWEEN OVERT TIME-ON-TASK, COVERT TIME-ON-TASK AND ACHIEVEMENT IN THE THREE SAMPLES

Sample/Measure	N	Correlation With Achievement	Intercorrelations of Overt and Covert Measures	Correlation of Overt and Covert Measures With Achievement
Arithmetic	27			.59
Overt		.39	.47	
Covert		.49		
Algebra	28			.62
Overt		.68	.64	
Covert		.47		
Matrix Arithmetic	82			.58
Overt		.38	.36	
Covert		.55		

Table 3

MEANS, STANDARD DEVIATIONS, AND CORRELATIONS OF OVERT AND COVERT TIME-ON-TASK AND ACHIEVEMENT IN THE THREE SAMPLES

	Measure-Situation											
	Overt-Lecture			Overt-Seatwork			Covert-Lecture			Covert-Seatwork		
Sample	Mean	S.D.	r	Mean	S.D.	r	Mean	S.D.	r	Mean	S.D.	r
Arithmetic	68.2	16.9	.52	79.3	9.4	.10	56.4	15.7	.44	59.4	19.2	.51
Algebra	71.7	14.7	.75	80.3	10.3	.42	72.2	17.9	.51	71.3	16.2	.45
Matrix Arithmetic	(	n/a[9]	)	86.3	8.3	.38	(	n/a	)	60.3	18.1	.55

FOOTNOTES

[1]This distinction is made by Staats (1968).

[2]See, for example, Morrison (1926), Wheat (1931), and Dewey (1938).

[3]See James (1890) and Titchener (1908).

[4]See Mostofsky (1968).

[5]See, for example, Edminston and Rhoades (1959), Lahaderne (1968), Turnure and Samuels (1972), and Cobb (1970), (1972).

[6]See, for example, Krauskopf (1963), Siegel et. al. (1963), and Stern et al. (1956).

[7]The students were told to "Think back to the class period and write what you were thinking at that time."

[8]The students were instructed as follows: "Please stop working. Just before you were aware of my voice you were thinking about something else. Write what you were thinking at that time."

[9]For the matrix arithmetic class the entire class period consisted of seatwork. Since there was no lecture situation in this class, two cells in the above matrix are not applicable (n/a).

[10]The difference between strength of correlation in the following discussion is based on the variance interpretation of the correlation coefficient.

REFERENCES

Anderson, L. W. Time and school learning. Unpublished Ph.D. Dissertation, University of Chicago, 1973.

Bloom, B. S. Thought processes in lectures and discussions. Journal of General Education, 1953, 1, 160-169.

_______., Hastings, J. T., and Madaus, G. F. Handbook on formative and summative evaluation of student learning. New York: McGraw-Hill, 1971.

Cobb, J. A. Relationship of discrete classroom behaviors to fourth grade academic achievement. Journal of Educational Psychology, 1972, 63, 74-80.

_______. Survival skills and first-grade academic achievement. Center at Oregon for Research in the Behavioral Education of the Handicapped, Department of Special Education, University of Oregon, 1970.

_______., and Hops, H. Effects of academic survival skill training on low achieving first graders. Center at Oregon for Research in the Behavioral Education of the Handicapped, Department of Special Education, University of Oregon, 1972.

Dewey, J. Experience and education. New York: Kappa Delta Phi, 1938.

Edminston, R. W., and Rhoades, B. J. Predicting achievement. Journal of Educational Research, 1959, 52, 177-180.

Heyn, R., and Lippitt, R. Systematic observational techniques. In G. Lindzey, ed., Handbook of social psychology, Vol. I. Cambridge, Mass.: Addison-Wesley, 1954.

James, W. Principles of psychology. Vol. I. New York: Henry Holt and Co., 1890.

Krauskopf, C. J. Use of written responses in the stimulated recall method. Journal of Educational Psychology, 1963, 54, 172-176.

Lahaderne, H. M. Attitudinal and intellectual correlates of attitudes: A study of four classrooms. Journal of Educational Psychology, 1968, 59, 320-324.

Morrison, H. C. Practice of teaching in the secondary school. Chicago: University of Chicago Press, 1926.

Mostofsky, D. I. Attention research: The case of the verbal phantom. Journal of Education, 1958, 150, 4-19.

Oczelik, D. A. Student involvement in the learning task and cognitive achievement. Unpublished Ph.D. Dissertation, University of Chicago, 1973.

Patterson, G. R., Cobb, J. A., and Ray, R. S. Direct intervention in the classroom: A set of procedures for the aggressive child. In F. W. Clark, et. al. (ed.), Implementing behavioral programs in educational and clinical settings, Champaign, Illinois: Research Press, 1971.

Reid, J. B. Reliability assessment of observation data: A possible methodological problem. Child Development, 1970, 41, 1143-1150.

Rothkopf, E. Z. The concept of mathemagenic activities. Review of Educational Research, 1970, 40, 325-336.

Shane, J. G., and Shane, H. G. Ralph Tyler discusses bhhavioral objectives. Today's Education, 197? ? 41.

Shimron, J. Learning Activities in Individually Prescribed Instruction. Paper presented at the American Educational Research Association Convention, New Orleans, 1973.

Siegel, L., Siegel, L. C., Capretta, P. J., Jones, R. L., and Berkowitz, H. Student thoughts during class: A [illegible] of educational research. Journal of Educational Psychology [illegible], 45-61.

Staats, A. W. Learning, language, and cognition. New York: Holt, Rinehart, and Winston, 1968.

Stern, G. G., Stein, M. I., and Bloom, B. S. Methods in personality assessment. Glencoe, Illinois: The Free Press, 1956.

Titchener, E. B. Lectures on the elementary psychology of feelings and attention. New York: Macmillan Company, 1908.

Turnure, J. E., and Samuels, S. J. Attention and reading achievement in first grade boys and girls. Research report No. 43, University of Minnesota Research Development and Demand Ration Center in Education of Handicapped Children, 1972.

Tyler, R. W. Basic principles of curriculum and instruction, syllabus for education 320. Chicago: University of Chicago Press, 1950.

Wheat, H. G. The psychology of the elementary school. New York: Silver, Burdette and Company, 1931.

Wiley, D. E. Another hour, another day: Quantity of schooling, a potent path for policy. Unpublished manuscript, 1973.